What is Claimed is:

1. An imaging spectropolarimeter for measuring polarization of an electromagnetic signal, comprising:

an objective optic for receiving an electromagnetic signal;

a modulator optically connected with the objective optic for modulating the electromagnetic signal whereby a modulated electromagnetic signal results wherein the amplitude of each frequency component of the modulated electromagnetic signal is a function of the particular polarization state of each frequency component of the electromagnetic signal;

a linear polarizer configured to pass a single polarization of the modulated electromagnetic signal through an output thereof;

a tunable filter optically connected to receive the single polarization of the electromagnetic signal and being tunable through a frequency spectrum, the tunable filter being configured to output a plurality of electromagnetic signal samples at predetermined frequency increments;

a focal plane array comprising a plurality of pixels and being configured to receive each electromagnetic signal sample and output a spectrum signal for each pixel on the focal plane array; and

a processor configured to apply Fourier transformation to the spectrum signal to obtain at least one Stokes polarization vector component for each pixel in the focal plane array.

2. The imaging spectropolarimeter of claim 1, wherein the tunable filter comprises an acousto-optic modulator.

3. The imaging spectropolarimeter of claim 1, wherein the tunable filter comprises an electro-optic modulator.

4. The imaging spectropolarimeter of claim 1, wherein the tunable filter is tunable through a light frequency spectrum comprising the infrared or visible portions of the spectrum.

5. The imaging spectropolarimeter of claim 1, wherein the focal plane array is mounted within a camera system.

6. The imaging spectropolarimeter of claim 5, wherein the camera system comprises a frame rate which is greater than about one thousand frames per second.

7. The imaging spectropolarimeter of claim 1, wherein the focal plane array provides information concerning intensity for each pixel of the array at each predetermined frequency increment.

8. The imaging spectropolarimeter of claim 7, further comprising an analog to digital converter operatively connected to receive each electromagnetic signal sample from the focal plane array for converting the received waveform into a digital word.

9. The imaging spectropolarimeter of claim 8, wherein the processor is further configured to receive the digital word and calculate at least one component of a Stokes polarization vector of the electromagnetic signal for each pixel in the focal plane array.

10. The imaging spectropolarimeter of claim 9, wherein the processor is further configured to calculate four Stokes vector components ($s_0$, $s_1$, $s_2$, and $s_3$) of the electromagnetic signal for each pixel in the focal plane array.

11. The imaging spectropolarimeter of claim 1, wherein the modulator comprises:

a first optically thick retarder of birefringent material wherein a fast and a slow axis of the retarder define respective x and y axes of a rectangular coordinate system; and

a second optically thick retarder of birefringent material;

wherein the fast axis of the first optically thick retarder forms an angle of approximately forty-five degrees to the fast axis of the second optically thick retarder.

12. The imaging spectropolarimeter of claim 1, further comprising a focusing lens located between the tunable filter and the focal plane array.

13. An imaging spectropolarimeter for measuring polarization of an electromagnetic signal, comprising:

means for receiving an electromagnetic signal;

means for modulating the electromagnetic signal being interconnected with the receiving means whereby a modulated electromagnetic signal results wherein the amplitude of each frequency component of the modulated electromagnetic signal is a function of the particular polarization state of each frequency component of the electromagnetic signal;

means for linearly polarizing the modulated electromagnetic signal and outputting a polarized electromagnetic signal;

means for filtering the polarized electromagnetic signal being optically connected to receive the polarized electromagnetic signal and being tunable through a frequency spectrum, the filtering means also being configured to output a plurality of electromagnetic signal samples at predetermined frequency increments of the frequency spectrum;

array means for receiving each electromagnetic signal sample and outputting a spectrum signal; and

processing means for applying Fourier transformation to the spectrum signal to obtain at least one Stokes polarization vector component.

14. The imaging spectropolarimeter of claim 13, wherein the means for modulating comprises:

a first optically thick retarder of birefringent material wherein a fast and a slow axes of the retarder define respective x and y axes of a rectangular coordinate system; and

a second optically thick retarder of birefringent material and wherein the fast axis of the first optically thick retarder forms an angle of approximately forty-five degrees to the fast axis of the second optically thick retarder.

15. The imaging spectropolarimeter of claim 14, further comprising means for converting from analog to digital being operatively connected to receive the spectrum signal from the focal plane array for converting the spectrum signal into a digital word.

16. The imaging spectropolarimeter of claim 15, wherein the processor is further configured to receive the digital word and calculate at least one component of a Stokes polarization vector of the electromagnetic signal.